

What is claimed is:

1           1.    A method comprising:  
2           computing for a path that includes multiple links a first  
3           color vector that indicates colors that all of the multiple  
4           links include; and  
5           computing for the path a second color vector that  
6           indicates colors that none of the multiple links include.

1           2.    The method of claim 1 further comprising considering  
2           the path for inclusion in a label switched path (LSP) if the  
3           path includes all colors that must be included in the LSP and  
4           does not include any colors that must be excluded from the  
5           LSP.

1           3.    The method of claim 1 further comprising determining  
2           whether the path includes all colors that must be included in  
3           a label switched path (LSP) by performing an AND operation on  
4           the first color vector and a mask indicating colors that must  
5           be included in the LSP and determining if a result of the AND  
6           operation equals the mask.

1           4.    The method of claim 1 further comprising determining  
2           whether the path includes any colors that must be excluded  
3           from a label switched path (LSP) by performing an AND  
4           operation on the second color vector and a mask indicating  
5           colors that must be excluded from the LSP and determining if a  
6           result of the AND operation equals zero.

1           5.    The method of claim 1 further comprising  
2           automatically re-computing the first color vector and the  
3           second color vector if a characteristic of any of the multiple  
4           links changes.

1           6.    The method of claim 1 further comprising  
2    automatically re-computing the first color vector and the  
3    second color vector if one or more of the multiple links  
4    included in the path changes.

1           7.    The method of claim 1 wherein the colors indicate  
2    service characteristics of the multiple links.

1           8.    The method of claim 1 wherein the path runs through  
2    the Internet.

1           9.    A method comprising:  
2           calculating whether a path including multiple links  
3    includes all colors that must be included in a label switched  
4    path (LSP); and  
5           calculating whether the path includes any colors that  
6    must be excluded from the LSP.

1           10.   The method of claim 9 further comprising considering  
2    the path for inclusion in the LSP if the path includes all  
3    colors that must be included in the LSP and does not include  
4    any colors that must be excluded from the LSP.

1           11.   The method of claim 9 in which the calculating is  
2    performed automatically.

1           12.   The method of claim 9 wherein calculating whether  
2    the path includes all colors that must be included in the LSP  
3    includes performing an AND operation on a color vector of the  
4    path that indicates colors that all of the multiple links  
5    include and a mask indicating colors that must be included in  
6    the LSP and determining if a result of the AND operation  
7    equals the mask.

13. The method of claim 9 wherein calculating whether the path includes any colors that must be excluded from the LSP includes performing an AND operation on a color vector of the path that indicates colors that any of the multiple links include and a mask indicating colors that must be excluded from the LSP and determining if a result of the AND operation equals zero.

14. The method of claim 9 further comprising automatically determining if the path is eligible for inclusion in the LSP based on whether the path includes all colors that must be included in the LSP and whether the path includes any colors that must be excluded from the LSP.

15. The method of claim 9 further comprising concurrently performing the calculation of whether the path includes all colors that must be included in the LSP and the calculation of whether the path includes any colors that must be excluded from the LSP.

16. The method of claim 9 further comprising first performing the calculation of whether the path includes all colors that must be included in the LSP or the calculation of whether the path includes any colors that must be excluded from the LSP, and

performing the other calculation only if the first calculation determines that the path includes all colors that must be included in the LSP or excludes all colors that must be excluded from the LSP.

17. The method of claim 9 further comprising setting up the LSP.

1 18. The method of claim 9 wherein the path includes  
2 stacked LSPs.

1 19. The method of claim 9 wherein the colors indicate  
2 service characteristics of the multiple links.

1 20. The method of claim 9 wherein the calculations are  
2 performed when one or more of the multiple links changes.

1 21. An article comprising a machine-readable medium  
2 which stores machine-executable instructions for computing  
3 resource color for composite links, the instructions causing a  
4 machine to:

5 calculate whether a path including multiple links  
6 includes all colors that must be included in a label switched  
7 path (LSP); and

8 calculate whether the path includes any colors that must  
9 be excluded from the LSP.

1 22. The article of claim 21 further causing a machine to  
2 consider the path for inclusion in the LSP if the path  
3 includes all colors that must be included in the LSP and does  
4 not include any colors that must be excluded from the LSP.

1 23. The article of claim 21 in which the calculating is  
2 performed automatically.

1 24. The article of claim 21 wherein calculating whether  
2 the path includes all colors that must be included in the LSP  
3 includes performing an AND operation on a color vector of the  
4 path that indicates colors that all of the multiple links  
5 include and a mask indicating colors that must be included in  
6 the LSP and determining if a result of the AND operation  
7 equals the mask.

25. The article of claim 21 wherein calculating whether the path includes any colors that must be excluded from the LSP includes performing an AND operation on a color vector of the path that indicates all of the colors that any of the multiple links include and a mask indicating colors that must be excluded from the LSP and determining if a result of the AND operation equals zero.

26. The article of claim 21 further causing a machine to automatically determine if the path is eligible for inclusion in the LSP based on whether the path includes all colors that must be included in the LSP and whether the path includes any colors that must be excluded from the LSP.

27. The article of claim 21 further causing a machine to concurrently determine whether the path includes all colors that must be included in the LSP and determine whether the path includes any colors that must be excluded from the LSP.

28. The article of claim 21 further causing a machine to first perform the calculation of whether the path includes all colors that must be included in the LSP or the calculation of whether the path includes any colors that must be excluded from the LSP, and

perform the other calculation only if the first calculation determines that the path includes all colors that must be included in the LSP or excludes all colors that must be excluded from the LSP.

29. The article of claim 21 further causing a machine to set up the LSP.

1 30. The article of claim 21 wherein the path includes  
2 stacked LSPs.

1 31. The article of claim 21 wherein the colors indicate  
2 service characteristics of the multiple links.

1 32. The article of claim 21 wherein the calculations are  
2 performed when one or more of the multiple links changes.

1 33. An apparatus comprising:  
2 a mechanism configured to route data between devices  
3 configured to connect to a network; and  
4 a process accessible by the mechanism that is configured  
5 to automatically compute two color vectors for a path running  
6 across the network and including multiple links.

1 34. The apparatus of claim 33 wherein the process is  
2 also configured to perform the automatic computing if one or  
3 more of the multiple links changes.

1 35. The apparatus of claim 33 wherein the mechanism is  
2 also configured to consider the path for inclusion in a label  
3 switched path (LSP) across the network if the path includes  
4 all colors that must be included in the LSP and does not  
5 include any colors that must be excluded from the LSP.

1 36. The apparatus of claim 33 wherein computing one of  
2 the color vectors includes determining whether the path  
3 includes all colors that must be included in a label switched  
4 path.

1 37. The apparatus of claim 36 wherein determining  
2 whether the path includes all colors that must be included in  
3 a label switched path (LSP) includes performing an AND

operation on a color vector of the path that indicates colors that all of the multiple links include and a mask indicating colors that must be included in the LSP and determining if a result of the AND operation equals the mask.

38. The apparatus of claim 33 wherein computing one of the color vectors includes determining whether the path includes any colors that must be excluded from a label switched path.

39. The apparatus of claim 38 wherein determining whether the path includes any colors that must be excluded from a label switched path (LSP) includes performing an AND operation on a color vector of the path that indicates all of the colors that any of the multiple links include and a mask indicating colors that must be excluded from the LSP and determining if a result of the AND operation equals zero.

40. The apparatus of claim 33 wherein the process is also configured to determine if the path is eligible for inclusion in the LSP based on whether the path includes all colors that must be included in the LSP and whether the path includes any colors that must be excluded from the LSP.

41. The apparatus of claim 33 wherein the mechanism is also configured to notify other devices of the computed color vectors.

42. The apparatus of claim 33 wherein the mechanism is also configured to set up a label switched path across the network.

43. The apparatus of claim 33 wherein the process includes software to automatically compute the color vectors.